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Helicobacter pylori infection in a multi-ethnic population in east coast of Borneo, Malaysia: The effects of ethnicity

Ooi-Cheng Lee, Chung-Ket Lai✉

Duchess of Kent Hospital, Sandakan, Sabah, Malaysia

ABSTRACT

Objective: To determine the prevalence of *Helicobacter* (*H.*) *pylori* infection among the population of east coast of Borneo and explore the relationship between demographic factors, ethnicity and risk of *H. pylori* infection.

Methods: This cross-sectional study enrolled 211 patients who underwent elective oesophagogastroduodenoscopy in 2017. Demographic data, endoscopic indications as well as the results of the mucosal biopsy were obtained and analysed from the endoscopy unit registry.

Results: A total of 211 patients from 14 ethnic groups were enrolled in the study, most of were Chinese (28.4%), followed by Dusun (14.7%) and Songgai (13.7%). Overall, the period prevalence for 2017 was 44.5%. Multivariate logistic regression analysis showed an association between ethnicity and *H. pylori*. Bajau (adjusted odds ratio=5.612, *P*=0.005) and Dusun ethnic groups (adjusted odds ratio=7.359, *P*=0.001) were at a significantly higher risk of *H. pylori* infection compared to Chinese. However, the regression model only explained 11.6% (Cox & Snell Pseudo R^2) of the prevalence of *H. pylori* infection.

Conclusions: The period prevalence for 2017 was 44.5%, with certain indigenous ethnic groups having a higher risk than others. Clinicians should consider obtaining further history regarding the ethnic's culture and dietary practice prior to starting *H. pylori* eradication therapy.

KEYWORDS: *Helicobacter pylori*; Prevalence; Borneo; Ethnicity

1. Introduction

Dyspepsia is defined as pain or discomfort centered on the upper abdomen. It is an extremely common but not yet fully understood clinical problem[1]. One common etiology of dyspepsia is *Helicobacter* (*H.*) *pylori* infection. About 50% or more of the world population is infected with *H. pylori*, making it one of the most widespread infections across the globe. *H. pylori* is known to be more prevalent in developing countries and it can result in ulcers and complications such as bleeding or perforation if left untreated. It thus poses heavy morbidity and economic impact towards the healthcare system[2].

Significance

It remains unknown which indigenous group of Sabah population has the highest prevalence of *H. pylori*. The current study showed that Bajau and Dusun ethnic groups were at a significantly higher risk of *H. pylori* infection compared to Chinese. Clinicians should consider learning more about the culture and dietary habits of the ethnic group before initiating *H. pylori* eradication therapy.

✉To whom correspondence may be addressed. E-mail: ahlai1976@yahoo.com

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In Malaysia, *H. pylori* infection rates have been reported between 19%-38.2%[3]. Studies in Peninsular Malaysia demonstrated that Indian and Chinese communities have higher proportion of *H. pylori* infection compared to Malay population[4–6]. However, only small number of studies on *H. pylori* infection have been conducted in Sabah and Sarawak (east Malaysia). A single centre study by Chai *et al*. concluded that the indigenous group have higher incidence of *H. pylori* infection compared to the Chinese ethnic group[7]. Previously, Goh KL conducted sero-epidemiology of *H. pylori* among different ethnic groups and found that *H. pylori* prevalence was 55% in Sabah and indigenous group had higher odds to be infected compared to the other ethnic groups[8]. In both studies, the risk factors of *H. pylori* infection amongst indigenous population of Borneo were not fully explored.

Sabah is part of Borneo and consists of 42 indigenous groups with various cultural practices and socio-economic backgrounds[9]. However, knowledge of *H. pylori* infection is limited among many ethnic and indigenous population in Sabah. Hence, this study was to explore the risk of *H. pylori* infection among different ethnic groups in Sabah. The main objectives were to determine the prevalence of *H. pylori* infection among the population of east coast of Borneo and explore the relationship between demographic factors, ethnicity and the risk of *H. pylori* infection.

2. Materials and methods

2.1. Ethical Approval

This study obtained ethical approval from the Medical Research and Ethics Committee (MREC) of Malaysia. [No.NMRR-18-3073-44823]

2.2. Methodology

This was a cross-sectional study conducted in a district hospital as well as being the only hospital that exclusively provides endoscopic services, covering the area of 28000 square kilometre. This study included all consented patients who underwent selective oesophagogastroduodenoscopy (OGDS) from January 1 to December 31, 2017, either with indication of organic or non-organic dyspepsia, or the others who had indications of screening or postoperative surveillance for malignancy.

Mucosal samples were biopsied and performed using Rapid Urease Test (Pronto Dry; Pentland Medical) for individual patients. A positive Rapid Urease test indicates the presence of *H. pylori* infection. Demographic data, endoscopic indications as well as the results of the mucosal biopsy were obtained from the endoscopy unit registry. Emergency cases were excluded as the cases were all due to upper gastro-intestinal bleed. As blood decreases the sensitivity of Rapid Urease Test due to the presence of albumin[10], those cases were excluded to prevent over-reporting.

After data collection, the analysis was done using R-studio software (R-studio; Public Benefit Corporation). Findings were presented descriptively using mean (SD) and median (IQR) for normally and non-normally distributed continuous variables, respectively, while results of categorical variables were presented as frequencies (*n*) and percentages (%). Linear regression was used to assess independent association between the outcome variable. Multivariate logistic regression analysis was used to select variables by stepwise methods, analyse the clinical indications of *H. pylori* infection and associated demographic factors (including age, gender, ethnicity, marital status), check for multicollinearity and no factors were removed from the generalized linear model. Interactions between predictor variables were examined and model fitness was assessed using Hosmer-Lemeshow goodness-of-fit test as well as Receiver Operator Characteristic curve analysis. A value of $P<0.05$ was considered statistically significant.

3. Results

A total of 211 consecutive patients were enrolled in the study, aged from 13 to 88 , comprising 111 males and 100 females. Overall there were 14 ethnic groups, majority being Chinese (28.4%), followed by Dusun (14.7%) and Sungai (13.7%).

The prevalence of *H. pylori* among patients who had OGDS was 44.5% (94/211). Table 1 shows the demographic distribution of the patients with presence of *H. pylori* infection. For ethnicity, major ethnic groups were included for analysis, while 6 minor ethnic groups such as Kegayan, Bisaya and Murut ethnics were categorized into others.

Table 1. Demographic and ethnic data of patients with *Helicobacter pylori*.

Factors	Overall	Pronto test	
		Negative	Positive
Age (years) (mean± SD)	50.6± 17.1	51.0 ±16.8	50.1 ±17.6
Gender [*n* (%)]			
Male	111 (52.6)	60 (54.1)	51 (45.9)
Female	100 (47.4)	57 (57.0)	43 (43.0)
Ethnicity [*n* (%)]			
Chinese	60 (28.4)	43 (71.7)	17 (28.3)
Malay	7 (3.3)	5 (71.4)	2 (28.6)
Bajau	18 (8.5)	6 (33.3)	12 (66.7)
Dusun	31 (14.7)	8 (25.8)	23 (74.2)
Kadazan	21 (10.0)	11 (52.4)	10 (47.6)
Sungai	29 (13.7)	17 (58.6)	12 (41.4)
Bugis	23 (10.9)	14 (60.9)	9 (39.1)
Suluk	8 (3.8)	4 (50.0)	4 (50.0)
Others	14 (6.6)	9 (64.3)	5 (35.7)
Marital status [*n* (%)]			
Single	21 (10.0)	15 (71.4)	6 (28.6)
Married	189 (89.5)	102 (54.0)	87 (46.0)
Widowed	1 (0.5)	0 (0)	1 (100)
Indication for OGDS [*n* (%)]			
Post-operative surveillance	14 (6.6)	11 (78.6)	3 (21.4)
Screening for malignancy	8 (3.8)	3 (37.5)	5 (62.5)
Dyspepsia	176 (83.4)	98 (55.7)	78 (44.3)
Others	13 (6.2)	5 (38.5)	8 (61.5)

SD: Standard Deviation; OGDS: oesophagogastroduodenoscopy.

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Table 2 shows the results of the univariate and multivariate logistic regression of patients' demography with *H. pylori* infection. Age, gender, marital status and indication for OGDS were not statistical significant. On the other hand, ethnicity was identified as a risk for *H. pylori* infection (P=0.002), of which the Bajau and Dusun ethnic groups had 5.6 times higher odds (P=0.005) and 7.4 times higher odds (P=0.001) respectively of being infected with *H. pylori* compared to those of Chinese ethnicity. However, in this study, dyspepsia was not considered a significant risk of having *H. pylori* infection ($P \geqslant 0.95$).

Data for this study was collected in 2017 and analyzed in 2020, and re-analyzed on similar dataset in Feburary 2022 with similar results. The analysis of all variables showed the regression model had an acceptable fit by Hosmer-Lemeshow goodness of fit test [X^2 (df) =2.1924(8), P=0.9745] as well as with Receiver Operator Characteristic curve analysis with Area Under the Curve with an acceptable level of 70.1%. However the model only explained 11.6% (Cox & Snell Pseudo R^2) of the prevalence of *H. pylori* infection of this study.

Table 2. Univariate & multivariate logistic regression analysis for factors associated with *Helicobacter pylori* infection.

Factors	Univariate logistic regression				Multivariate logistic regression			
	Crude *OR*	95% *CI*	X^2 (*df*)	*P*-value	Adjusted *OR*	95% *CI*	X^2 (*df*)	*P*-value
Gender								
Male	1	--			1	--		
Female	0.887	0.514-1.529	0.185 (1)	0.667	0.789	0.434-1.23	0.617 (1)	0.432
Ethnicity			23.244 (8)	0.003			23.135 (8)	0.002
Chinese	1	--		--	1	--		
Malay	1.011	0.136-5.210	0.013*	0.989	1.121	0.145-6.149	0.125*	0.891
Bajau	5.059	1.689-16.642	2.813*	0.005	5.612	1.769-19.617	2.842*	0.005
Dusun	7.272	2.825-20.410	3.964*	0.001	7.359	2.766-21.358	3.856*	0.001
Kadazan	2.299	0.821-6.474	1.594*	0.111	2.188	0.773-6.217	1.485*	0.141
Sungai	1.785	0.700-4.535	1.224*	0.221	1.833	0.685-4.913	1.213*	0.229
Bugis	1.626	0.581-4.446	0.945*	0.345	1.516	0.517-4.356	0.771*	0.460
Suluk	2.529	0.543-11.844	1.216*	0.224	2.593	0.541-12.552	1.222*	0.223
Others	1.405	0.385-4.705	0.543*	0.587	1.353	0.347-4.871	0.455*	0.649
Marital status								
Unmarried	1	--			1	--		
Married	1.828	0.735- 4.974	1.656 (1)	0.198	2.216	0.744-7.25	2.013 (1)	0.156
Indication for OGDS		--				--		
Non-dyspeptic	1				1			
Dyspeptic	0.945	0.456-1.978	0.023 (1)	0.879	0.998	0.451-2.237	0.001 (1)	0.997

OR: Odds Ratio; *CI*: Confidence Interval; *df*: degree of freedom; *: Z-test; --: No data; OGDS: oesophagogastroduodenoscopy.

4. Discussion

In this study, the period prevalence for *H. pylori* infection was about 44.5% and this was comparable to the findings by Goh KL[8] who reported a prevalence of 55% among indigenous population. Nevertheless, the *H. pylori* prevalence in our sample was comparatively higher than the globally reported Malaysian ranges of 19%-38.2%[3], as the true prevalence of *H. pylori* in Sabah may be lower due to the method of sampling used (convenience sampling). Furthermore, being the referral centre for OGDS which covers 28000 square kilometre, subjects' medical records were taken from an endoscopy unit, and thus increases the proportion of those diagnosed with *H. pylori*.

Reviews demonstrated that *H. pylori* infection was significantly higher among those with dyspepsia compared to those who were asymptomatic[11,12], as well as *H. pylori* eradication therapy improveed the symptoms of dyspepsia. Our data showed 83.4% of the subjects underwent OGDS because of dyspepsia. However, our study concluded that there were no statistical association between dyspepsia and *H. pylori* infection. This might be due to other causes of dyspepsia such as functional dyspepsia, alcohol consumption[13], and drugs such as non-steroidal anti-inflammatory drugs[14], but details regarding drug history or history of alcohol consumption were unavailable within the medical records, which is a limitation for this study.

Multiple studies have shown that the difference in prevalence among the major ethnic groups of Malaysia which consist of Malay, Chinese and Indian[15,16]. Nonetheless, the strength of our study was the ability to demonstrate that specific ethnic group in Borneo were at risk to be infected by *H. pylori*, which no other studies have discovered. Our study used the Chinese ethnic group as the reference group for statistical analysis due to the recent study in Borneo reported the Chinese having lower risk of *H. pylori* infection compared to indigenous population[7]. We reported that few indigenous groups were at higher odds of being infected due to the different cultural and dietary practice of food consumption which

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use more preserved and salted food, and regular consumption of salted food increases the risk of *H. pylori* infection[17,18]. Malaysian indigenous population were generally from low socio-economic background[19], consequently, families lived in an overcrowded houses with non-optimal sanitation and water filtration, which increased the risk of being infected by *H. pylori*[20]. However, as part of the limitation of this study, details of patients' socio-economic background as well as individual ethnic dietary practice were not within the medical records, therefore this lack of information serves as a platform for future researches to explore on different dietary practice and sanitation among each ethnic group with the risk of *H. pylori* infection or large-scale studies that compare every ethnic groups both in Borneo and Peninsular of Malaysia.

In Asia, there may be some genetic variations among different population. The variable genetic expression of the person may increase[21] or decrease the risk of being infected[22] by *H. pylori*. So far in Malaysia, a few studies have demonstrated that there is an association between the genetic constitution of individual ethnicity and *H. pylori* infection[23,24], however they did not have information regarding indigenous population of Peninsular or Borneo. But the risk of being infected may also be due to the virulence of the bacteria. In Vietnam, some ethnic groups were statistically more at risk of being infected by *H. pylori*, as well as significant difference in histological scores and genotypes between each group[25]. Similarly, in Thailand, there were different distributions of *H. pylori* strains among independent ethnic groups[26]. In Malaysia, it was reported that the Chinese ethnic group was more prone to be infected with metronidazole-sensitive *H. pylori* strains, whereas Malay and Indian population were more likely to be infected with the antibiotic-resistant strains[23, 27]. This is due to the difference in genomic sequence of *H. pylori* present in each ethnic group of Malaysia[28]. However, there is no available study to discuss the antibiotics-resistance and virulence of *H. pylori* in Borneo. There is also gaps of knowledge regarding genetic predisposition of the indigenous population of Borneo. Hence more research indicated for genetic exploration about the host as well as the pathogen, as it may alter the treatment of *H. pylori* eradication in terms of choice of antibiotics.

In conclusion, the period prevalence for this study was 44.5%, with certain indigenous ethnic groups had higher risk than the other. Clinicians should consider obtaining further history regarding the ethnic's culture and dietary practice prior to starting *H. pylori* eradication therapy, specifically in certain ethnic groups with dyspepsia in a primary care setting or centres with limited resources. However patients must be individually assessed before initiation of eradication therapy to ensure the maximal benefit for them.

Conflict of interest statement

The authors claim they have no conflict of interest.

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Authors' contributions

Dr Ooi was responsible for literature collection, writing the draft of the article, methodology planning, local ethical application, data collection, data management, and data analysis. As the corresponding author, Dr Ooi controlled the content of the whole review. Dr Lai serves as the content matter expert and supervisor for the entire study.

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